PROCEEDINGS

OF

THE ROYAL IRISH ACADEMY.

MONDAY, NOVEMBER 9, 1857.

James Henthorn Todd, D. D., President, in the Chair.

On the recommendation of the Council the following Resolutions were adopted:—

1. To authorize the Treasurer to pay a sum of £41 5*s.* 11*d.*, to liquidate the Balance of the cost of printing the Museum Catalogue and arranging the Museum,—this sum being in addition to the sum of £250 voted on the 16th March last.

2. That all moneys derived from the sale of the Catalogue, after the expenses of Advertising, &c., be devoted to the publication of the second part of that work.

Rev. R. Carmichael read a paper on some Brief Methods in the Integral Calculus.

Sir W. R. Hamilton gave an account of some researches of his own on the Theory of Definite Integrals.

MONDAY, NOVEMBER 30, 1857. (Stated Meeting.)

James Henthorn Todd, D. D., President, in the Chair.

In consequence of the unavoidable absence of the author, the following paper by the Rev. T. R. Robinson, D. D., was read by the President—

ON THE LIFTING POWERS OF ELECTRO-MAGNETS.

This paper constituted the third part of Dr. Robinson's researches on the lifting power of the Electro-magnet. In it he examines the dependence of this power on the length and inductivity of the magnetic circuit which is formed when the poles are connected by a keeper. Whatever lessens the inductivity, lessens the magnetic power. If the circuit be incomplete, or if the middle of the keeper or of the magnet be brass, the power decreases to 0·70 or 0·08, or even to 0·02 of its normal amount. Plates of brass $0^{i}\cdot12$ thick interposed between the keeper and poles produce a similar effect; and even the minute interval which re-

mains when they seem in contact is sufficient to destroy $\frac{1}{14}$ of the entire power.

As iron does not transmit magnetic induction without diminution, the same decrease of power is caused by either increasing the circuit or placing the helices at a greater distance from the poles. In the first case, varying the circuit from 12^{i} to 32^{i} reduces the power to $\frac{1}{2}$, in the second changing the distances from $0^{i}\cdot 1$ to 10^{i} brings it to $0\cdot 87$.

If the helices be on one arm only, the poles are unequally excited, the adjacent one more, the remote less, than would be done by the same amount of excitation equally divided between the two arms.

Tables of these results are given, from which he at first hoped to ascertain the law connecting the power with these variables. The problem appears too complicated to be solved by experiment alone, but he offers them as useful data both for theoretic research and practical application.

Various magnets are compared: in general, the lifting power is greater the shorter the magnet, and the closer the spires are brought to its poles; if it be intended to act at a distance, or to magnetize hard steel, it should be long, and uniformly covered with spires.

Beyond 2^{i} diameter, or even less, the central part of the magnet seems not to contribute to its power.

The power decreases with a rise of temperature if the magnet be iron, the rate varying with its length and section; if of hard steel, it increases, and much more rapidly.

Both with iron and steel there remains magnetism if the exciting current be withdrawn; in the latter case it is permanent and of large amount, and is not destroyed by reversing the current (unless that be of a certain power), even though it produce a temporary reversal of polarity while passing. The power of steel is with ordinary exciting forces far less than that of iron, but with higher they tend to equality.

If a table of the successive powers of a magnet and the corresponding exciting forces be examined, it is seen that they are not proportional, except approximately at the beginning of the series. The increase of the first for a given increase of the second diminishes constantly, and so as to show that in every instance there is a maximum which no amount of current force or number of spires can pass. The precise relation between the power and exciting force has not yet been determined, but he finds that the following empirical formula represents very well, except for the very lowest powers, the action of the seven magnets with which he worked—

$$L = \frac{A\psi}{B + \psi},$$

in which A is the maximum power; ψ the exciting force measured by the quantity of the current $\times$ number of spires; and B a constant which may be called the modulus of the magnet, and seems to possess some remarkable properties. It is the ψ which produces a power $= \frac{1}{2}A$, and below which the permanent magnetism is not reversed completely. Below it, also, what he calls residual excitation, that which remains

after the current ceases, and till the keeper is raised, varies; above it, it is constant.

The paper concludes with a summary of its contents and those of the two preceding it.

A perfect copy of Charles Brooking's map of Dublin, published in 1728, with a view of the city, and fronts of the public buildings, was presented by Miss Wilkinson.

A list of donations of books presented was read, and thanks voted to the donors.

MONDAY, DECEMBER 14, 1857.

JAMES HENTHORN TODD, D. D., President, in the Chair.

The Rev. Robert Carmichael read a Paper on the Singular Solutions of Partial Differential Equations.

William Kelly, M. D., R. N., read the following Paper on—

THE ANNUAL VARIATIONS OF ATMOSPHERIC PRESSURE IN THE GULF OF ST. LAWRENCE.

The Table which accompanies this Paper is an abstract from the "Meteorological Journal of the Naval Surveying Party" on the St. Lawrence. The observations from which it is taken extend over nine years, from 1841 to 1850. They were made on board the Gulnare surveying vessel, from the end of May in each year, to the middle of October; and during the remainder of the year at Charlotte Town, Prince Edward Island, where the party wintered.

Two ordinary marine barometers were employed in making these observations. The first got out of order in June, 1845, and the second was not obtained until the September following. The indications of the latter were somewhat lower than those of the first, which agreed generally with other barometers of the same construction. There was no apparent difference, however, in the range of the instruments, which, it is scarcely necessary to say, was less than the true range; not only on account of the varying level of the mercury in the bag, according as it ascends or descends in the tube; but also from hygrometric causes acting on the bag itself; the instruments having been kept in the moist air of a vessel at sea during the summer, and in the dry air of a house warmed by stoves during the winter.

From the mean of all the observations we find that the atmospheric pressure is least in January, February, and March; that it increases slowly in April and May, and that there is a very slight decrease (·01) in June; that the pressure is greatest in July, August, and September, after which it decreases gradually through the three remaining months of the year.

The annual course of atmospheric pressure which we find here, on the north-east coast of America, derives interest from the fact that a similar